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ABSTRACT

A study was conducted to determine if different levels of implementation of an interactive videodisc-based instructional program in mathematics differentially affected the academic achievement of regular students and students with disabilities in mainstreamed classrooms. The videodisc program was designed to be controlled by a teacher in group instruction. Thirty-eight students with disabilities who normally receive mathematics instruction in a resource room, received the majority of instruction in a regular classroom. Additional instruction was provided to these students by resource room teachers using the interactive video program. Seventy-one regular education students and 38 resource students received video-based instruction in 9 fifth grade classrooms. Students were classified as high-achievers, low-achievers, and low achievers with special needs (resource students). Students were administered a criterion-referenced pretest and posttest. Data were also collected on the amount of extra help received by the resource students and on level of implementation. Teachers were divided into high, average, and low implementors of the program. The results of a two-way analysis of the covariance showed statistically and educationally significant differences in implementation level and type of student. There was also a statistically significant interaction between implementation level and type of student. This suggests that there is a strong relationship between the level of implementation and student achievement. (9 references) (Author/DB)

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DETERMINING THE DIFFERENTIAL EFFECT ON MATH ACHIEVEMENT OF LEVELS OF IMPLEMENTATION OF A VIDEODISC-BASED PROGRAM WITH REGULAR AND MILDLY HANDICAPPED STUDENTS

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Abstract

A study was conducted to determine if different levels of implementation of a videodisc-based instructional program in mathematics differentially affected the achievement of regular students and students with disabilities in mainstreamed classrooms. The videodisc program was designed to be controlled by a teacher in group instruction. Students with disabilities who normally receive math instruction in a Resource Room, received the majority of instruction in a regular classroom. Additional instruction was provided to students with disabilities by Resource Room teachers using the videodisc-based program.

Seventy-one regular education students and 38 resource students received videodisc-based instruction in nine fifth grade classrooms. Students were classified as high-achievers, low-achievers, and low-achievers with special needs (resource students).

Students were administered a criterion-referenced pre-test and post-test. Data were also collected on the amount of extra help received by the resource students and on level of implementation. Teachers were divided into high, average and low implementers of the program.

The results of a two-way analysis of the covariance showed statistically and educationally significant differences in implementation level and type of student. There was also a statistically significant interaction between implementation level and type of student.

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Purpose and Objectives

Overview

A study was conducted to determine if different levels of implementation of a videodisc-based instructional program differentially affected the achievement of regular and mainstreamed mildly handicapped students. The videodisc program uses a direct instruction approach to teach fractions to fifth-grade students; was designed to be controlled by a teacher in group instruction; and contains instruction of fractions concepts, guided practice activities, quizzes and mastery tests. The students with disabilities in mathematics achievement in the study normally received math instruction in a resource room. Such resource-room instruction is required by law for students with disabilities. Thus, it was not possible to completely withhold resource room instruction during the course of the study. However, during the study, the resource students received at least 50% of their fractions instruction in the regular classroom with the regular education students and from the regular teacher in addition to their resource room instruction. The average time spent by a regular-education pupil was about three hours per week. In addition to this time, pupils with math disabilities spent an average of three hours in math resource room per week. The math resource teachers were asked to provide instruction using the videodisc-based program, to reinforce the classroom instruction. The resource teachers used the videodisc program, but also delivered some additional math instruction as they saw fit.

The instructional content and strategies contained on the videodisc program were derived from research on effective teaching (Brophy & Good, 1986; Rosenshine & Stevens, 1986) and Direct Instruction (Engelmann & Carnine, 1982). According to the program developers, the extent to which the program is implemented as designed is crucial to the success of the program. Consequently, measuring program implementation was of particular interest to the researchers and has implications for teaching methods research.

Objective

The major objective of the study was to assess the level at which the teacher implemented the program and to determine if level of implementation differentially affects the math achievement of regular and mildly handicapped students/students with mathematics disabilities.

Perspectives

Mainstreaming

An assessment of current policy trends reveals a concerted and intense effort to involve regular educators more in the education of mildly handicapped students and to continue to encourage the use of mainstreamed classrooms. Regular and special educators, however, have serious concerns about the effect of mainstreaming on the academic and social growth of students with mild handicaps. In many cases regular classroom teachers are unable or unwilling to alter their basic instruction to accommodate handicapped students (Reynolds, Wang, & Walbert, 1987; Will, 1986). Consequently, it is crucial to develop or identify instructional programs which provide effective instruction for all students in mainstreamed classrooms. It is also crucial that these programs be implemented as designed.

Program Implementation

Many researchers of instructor-controlled instructional technologies try to ensure that the program is implemented as close to design specifications as possible (Mark, 1983; Kelly, 1986). By doing so, the researchr can verify the treatment variable, and so can argue that differences in the dependent variabgle are attributable to the program. Additionally, a number of authors have suggested that differences between what an instructional designer recommends and what is implemented in the classroom may have a significant effect on student achievement (e.g., Stake, 1967; Hall and Loucks, 1977). Unfortunately, program implementation is often not verified (Shaver, 1983).

Methods

Instructional Program

Rosenshine and Stevens (1986) provide a list of teaching processes in their operational definition of the daily functions of direct instruction:

1. Review, check previous day's work (and reteach, if necessary) ,
2. Present new content/skills,
3. Guide student practice (and check for understanding),
4. Provide feedback and correctives (and reteach, if necessary),
5. Provide independent student practice, and
6. Provide weekly and monthly reviews.

In direct forms of instruction, the teacher controls the content and pacing of instruction. But rote following of the direct instructional functions does not guarantee that students

will learn. Rosenshine and Stevens (1986) noted that the success of these techniques depends on specific ways of performing each of them. For example, content or skills should be presented in a clear and organized manner (item 2 above), haphazard presentation does not benefit the learner.

Direct forms of instruction have been observed by researchers studying existing effective-teaching. But the Direct Instruction Model has evolved from a theoretical/empirical base. For a detailed description of the model see Engelmann and Carnine (1982). The developers of the Direct Instruction Model have provided specific rules for the presentation and practice of concept recognition and skill performance. That is, general definitions of direct forms of instruction address instructional management, while the Direct Instruction Model also provides instructional design rules and message design guidelines.

The Mastering Fractions program is based on direct instruction principles and is designed to be presented to a heterogeneous class of students. It requires that a television or monitor, with a screen large enough to be read in all parts of the classroom, be placed at the front of the class. All students are seated facing the screen. The audio system must be clear and loud enough to be heard by all students. The program requires the Mastering Fractions videodiscs, a level-one videodisc player, consumable student worksheets, extra paper and pencils, and the teacher handbook (which includes answer keys for the seat work and tests).

Mastering Fractions consists of 35 lessons. Each lesson is designed to be completed in approximately 40 minutes. Most presentation/practice lessons begin with a quiz of the previous lesson's learning, and each fifth lesson is a mastery test. Both quizzes and mastery tests are followed by diagnostic/remedial suggestions based on specific skill weaknesses manifested by the students. Instruction is provided on the disc at three progressive levels--oral response, written practice with component skills and concepts, and written practice with articulated skills and problem-solving strategies (for more detail see Systems Impact, 1986).

Subjects

Students in nine classrooms received instruction in fractions via the teacher-directed, videodisc-based, Mastering Fractions program (Systems Impact, 1986). There were 71 regular education students and 38 resource students. Students were classified as high achievers, low achievers, and low achievers with special needs in mathematics (resource students).

The teachers in each classroom were given a half-day workshop on the use of the program, and were invited to call the researchers with their questions or comments. This procedure is consistent with the typical in-service training for the program.

Data Collection

Before instruction a criterion referenced pretest was administered. The same test was used as a posttest to measure achievement after the instruction. Data were also collectd on the amount of extra help in math that was received by the special education students. During the instruction, data were collected on differences in level of program implementation. To determine program implementation, an observational instrument was developed and was based on the program implementation strategies of the program deesigners. When the students in each class had finished the program, the observation ratings were averaged for each teacher on a per-observation-period basis. The teachers were then divided into three groups: high, average, and low implementers (three teachers in each group).

Data Analysis

A two-factor analysis of covariance was used to determine if there were statistically significant differences between the posttest mean scores for the two main effects (implementation levels and type of student) and if there was a statistical interaction between the two factors. The pretest served as a covariate.

Results

The results of the analysis show statistically significant differences in implementation level ($p = .000$) and type of student ($p = .000$) and a statistically significant interaction ($p = .009$). The mean scores (in percentage correct) are shown in Table 1.

Table 1. Postest Means Adjusted for Pretest Differences

Achievement Group	Implementation Level: High	Average	Low	Row Means
High Achievers	92.8	86.0	76.9	85.3
n-size	10	10	14	34
Low Achievers in Math-- Non-Special Education	77.5	79.2	51.0	69.2
n-size	15	8	14	37
Low Achievers in Math-- Special Education	86.4	66.5	42.3	65.4
n-size	12	16	10	38
Column Means	85.6	77.2	57.0	
n-size	37	34	38	109

The effect sizes for the levels of implementation are shown in Table 2. Normally the standard deviation of an untreated group is used as the denominator to compute a standardized mean difference effect size. However, all of the pretest scores were very low. Consequently, there was little variability among the scores. Use of the small untreated standard deviation would have been inappropriate, and would have resulted in inflated effect sizes. Instead, we used the pooled standard deviation of the posttest scores.

Table 2. Effect Sizes for the Implemenation Levels

Implementation Level	Effect Size
High vs. Average	+ 0.5
Average vs. Low	+ 1.2
High vs. Low	+ 1.7

Note that the means in Table 1 generally become smaller moving down the columns and left to right across the rows. There are two exceptions. The mean for low-achieving, regular education students in average-implementation classrooms is slightly higher than the mean for similar pupils in high-implementation classrooms. Note, however, that the cell represents the lowest of the cell n-sizes (n = 8), which may have some effect on the representativeness of the mean. The second exception is more dramatic. The cell containing the mean for special education pupils in high-implementing classrooms appears quite high. This phenomenon can also be seen in the interaction (see the figure below).

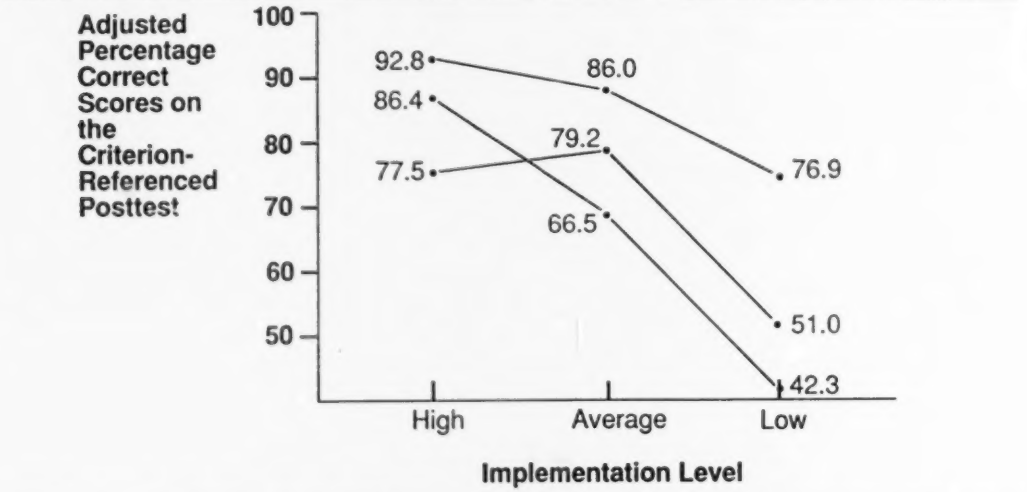

Figure: Interaction diagram for implementation and achievement group.

Discussion

The results suggest that there is a strong relationship between the level of implementation of the Mastering Fractions program and student achievement (note the column means in Table 1). Note too that the row means in Table 1 are consistent with what one would expect in a school setting. However, there is one cell that appears to be inconsistent with the rest of the results. Students with math disabilities who were in high-implementation classrooms scored higher than than non-math-disabled students in high implementing classrooms. Recall, that all of the math-disabled pupils were, by law, receiving help in a resource room in addition to the mainstreamed math instruction in their regular classroom. Although no causal link can be established, it is possible that the unique combination of high implementation and resource room instruction provided a particularly powerful combination for these students.

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